

# Assessment of Iranian Nurses and Emergency Medical Personnel in Terms of Cardiopulmonary Resuscitation Knowledge Based on the 2010 Guideline

## Abstract

**Background:** The aim of this study was to compare the cardiopulmonary resuscitation (CPR) knowledge of hospital nurses and emergency medical personnel in Kermanshah, Iran. **Materials and Methods:** This descriptive cross-sectional study was conducted on 330 hospital nurses and 159 emergency medical personnel working in educational hospitals and emergency medical centers in Kermanshah. Data were collected using a validated and reliable ( $r = 0.74$ ) researcher-made questionnaire consisting of a demographic characteristics questionnaire and the 2010 CPR knowledge questionnaire. **Results:** Based on the most recent CPR guidelines, the knowledge of 19.5%, 78.6%, and 1.9% of the emergency medical staff was excellent, good, and moderate, respectively. None of the participants had poor knowledge. In addition, the knowledge of 20.2%, 65.4%, 14%, and 0.4% of the nurses in this study was excellent, good, moderate, and poor, respectively. There was no significant difference in CPR knowledge between hospital nurses and emergency medical staff. Moreover, no significant association was found between CPR knowledge and gender, age, work experience, field of study, previous occupation, and advanced resuscitation courses. However, CPR knowledge of individuals with training in basic CPR courses was higher than participants without training in these courses ( $P < 0.05$ ). **Conclusions:** Based on the findings of this study, CPR knowledge among Iranian nurses and emergency medical personnel was in an acceptable range. Nevertheless, it is strongly recommended that nurses and emergency staff receive training according to the most recent CPR guidelines.

**Keywords:** Cardiopulmonary resuscitation, emergency medical technicians, Iran, knowledge, nurses

## Introduction

Advanced and up-to-date knowledge of cardiopulmonary resuscitation (CPR) is essential for all health care personnel. This subject has gained increasing attention and has been promoted over recent years.<sup>[1]</sup> The most recent CPR guidelines have focused on the use of automated external defibrillators (AED), firm and rapid pressure on the chest with a frequency of 100 times per minute at the beginning of the CPR, and ratio of heart massage to pulmonary ventilation during CPR of 30:2 in all age groups.<sup>[2]</sup>

In all age groups, pulmonary ventilation should be given for 1 second to avoid hyperventilation. In addition, only 1 shock in electroconvulsive therapy followed immediately for 2 minutes by chest massage and ventilation has been recommended. In the new guidelines for CPR, the use of a pacemaker for fibrillation is not recommended, whereas the use of resuscitation and medication

is emphasized.<sup>[3]</sup> Epinephrine and vasopressin are the most important drugs used for CPR.<sup>[3]</sup> Intraosseous routes are preferred in patients with inaccessible veins.<sup>[2]</sup> After resuscitation, the use of induced hypothermia is recommended.<sup>[1]</sup>

It is essential that the nursing education system instructs nurses on these principles and their correct application.<sup>[4]</sup> Previous studies have reported that these training programs can affect the basic knowledge of nurses on CPR.<sup>[5]</sup> Preusch *et al.* reported that, based on the 2005 guidelines for CPR, nurses' knowledge on CPR is low.<sup>[6]</sup> In addition, Passali *et al.* reported that the level of awareness regarding Basic Life Support (BLS) and Advanced Life Support (ALS) principles among nurses and doctors of Greece is not sufficient.<sup>[7]</sup> It has also been reported that emergency medicine staff have poor knowledge of resuscitation protocols,<sup>[8]</sup> however, they have the

Reza Pourmirza Kalhori<sup>1</sup>,  
Amir Jalali<sup>2</sup>,  
Arsalan Naderipour<sup>1</sup>,  
Afshin Almasi<sup>3</sup>,  
Mohammad Khavasi<sup>4</sup>, Masoud Rezaei<sup>5</sup>, Mohammad Abbasi<sup>6</sup>

<sup>1</sup>Department of Emergency Medicine, School of Paramedics, Kermanshah University of Medical Sciences, Kermanshah, Iran, <sup>2</sup>Department of Psychiatric Nursing, Faculty of Nursing and Midwifery, Kermanshah University of Medical Sciences, Kermanshah, Iran, <sup>3</sup>Department of Epidemiology and Biostatistics, Tehran University of Medical Sciences, Tehran, Iran, <sup>4</sup>Department of Nursing, Faculty of Nursing and Midwifery, Abadan University of Medical Sciences, Abadan, Iran, <sup>5</sup>Department of Research Committee, Faculty of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran, <sup>6</sup>Department of Medical-Surgical Nursing, Faculty of Nursing and Midwifery, Qom University of Medical Sciences, Qom, Iran

### Address for correspondence:

Dr. Mohammad Abbasi,  
School of Nursing and  
Midwifery, Qom University of  
Medical Sciences, Saheli Street,  
Qom, Iran.  
E-mail: Mohamad\_abbasi55@  
yahoo.com

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adequate skills to embed aggressive air routes in advanced resuscitation.<sup>[9]</sup> Furthermore, a delay in the administration of emergency drugs due to poor knowledge of the staff on medication was reported in some studies.<sup>[10]</sup> Observance of important practicable points that have been indicated in the most recent resuscitation guidelines can increase the number of successful resuscitation cases. Moreover, it is necessary that all individuals who perform CPR use these suggestions and recommendations in one way; the way they were taught, observed, and performed in the clinical environment. Furthermore, the most important elements of training require assessment for the improvement of postgraduate teaching programs. To our knowledge, no similar study has been performed in the Kermanshah University of Medical Sciences, Kermanshah, Iran, until today. Thus, this survey was conducted with the main goal of determining the level of awareness of the nursing staff and emergency medical technicians of Kermanshah regarding the 2010 resuscitation guidelines.

The principles listed in the most recent resuscitation guidelines can increase the success of the resuscitation process. Given the importance of the latest CPR knowledge for all health care personnel, especially the emergency medical staff, and retraining programs, the aim of this study was to compare CPR knowledge between hospital nurses and emergency medical staff in Kermanshah.

## Materials and Methods

### Design and participants

This descriptive cross-sectional study was performed in the Nursing Society of Kermanshah. Based on the pilot study with a confidence interval (CI) of 95% and power of 90%, the sample size was estimated as 330 individuals. The participants were selected through simple random sampling from the list of nurses of every hospital and among 159 emergency medical staff working in the emergency medical centers in Kermanshah during September 2012 to May 2013. The participants were divided into 4 groups. Sampling was performed by the researcher, and the selected participants filled the questionnaire voluntarily. The emergency medical personnel were categorized according to the location; 18.2% from headquarter centers, 71.7% from urban centers, and 10.1% from road centers.

### Data collection and tools assessment

Data on demographic characteristics and CPR knowledge of the participants was collected using a validated and reliable ( $r = 0.74$ ) questionnaire that was used by the researcher in a previous study.<sup>[11]</sup> This questionnaire contains 40 questions on CPR knowledge [Table 1]; the questionnaire includes the basic rules of initiation and termination of CPR, principles of establishing artificial ventilation and airway management, principles of external chest compressions and massage, and fundamentals of advanced resuscitation.

To determine the validity of this questionnaire, the questionnaire was distributed among 25 faculty members to obtain their feedback. A pilot study was conducted to determine the reliability of the questionnaire. In this pilot study, a Cronbach's alpha coefficient of 90% and Pearson's correlation coefficient of 0.74 were obtained. The total score of knowledge for each staff was measured, which varied from 0 to 40, which was then categorized as excellent (31 to 40), good (21 to 30), moderate (11 to 20), and poor (less than 10).

### Statistical analysis

Data were presented as average and standard deviation (SD) and percentage. For quantitative and qualitative data analysis, two-dimensional tables in number and percentage form were used. For the investigation of the equality of variance of the three groups, analysis of variance (ANOVA) was used. One-way ANOVA, Spearman's correlation, and Chi-square were used for comparison of the scores in all the groups. All  $P$  values of less than 0.05 were regarded as significant. All statistical analyses were conducted using STATA software (version 11, StataCorp, College Station, TX, USA).

### Ethical considerations

Ethical approval was obtained from the Faculty of Nursing and Midwifery, Kermanshah University of Medical Sciences, Kermanshah, Iran, before conducting the study with code number of 91015. Written informed consents were obtained from all participants.

## Results

The knowledge of 19.5%, 78.6%, and 1.9% of emergency medical staff was excellent, good, and moderate, respectively. None of the participants obtained a poor score. In addition, the knowledge of 20.2%, 65.4%, 14%, and 0.4% of the nurses in this study was excellent, good, moderate, and poor, respectively. No significant difference was observed between the two groups in CPR knowledge ( $P > 0.2$ ). The distribution of educational levels among emergency medical staff was as follows: Nurse's aides = 35.8%, emergency medical technicians = 36.5%, bachelor degree = 20.8%, and discontinuous bachelor degree = 6.9%. The mentioned distribution among nurses was as follows: Nursing technicians = 6.5%, bachelor degree = 86.6%, discontinuous bachelor degree = 4%, and graduate degree = 2.8%. In nurses, there was no statistically significant difference between awareness level of men and women. Although the average distinction of awareness level among subjects with master's degree was higher than other degrees, this finding was not statistically significant [Table 2].

In emergency medical staff, a significant inverse association was found between age and CPR knowledge, meaning older staff had less CPR knowledge compared with younger staff ( $r = -0.09$ ) ( $P = 0.009$ ). No significant

**Table 1: Characteristics of Questionnaire; question based on samples answers**

No	Questions about the legal aspects of CPR	Right answer (%)
1	Questions about the legal aspects of CPR	
1	If the patient requires CPR, we must wait for the doctor as the leader of the resuscitation team	85.7
2	Midrise double is a criterion for not starting CPR	20
3	CPR must be left to the specialist until returning of vital signs or assurance of certain death of the patient	95.5
4	In the case that the patient's family requests it, CPR can be stopped	25
5	If the rescuer's life is in danger, CPR can be stopped	51.1
6	CPR on frozen bodies, neck wounds, peripheral cyanosis, and circumstances in which there is no hope for improving the patient is not necessary	66.3
7	According to the neurologic state of the patient (decreased level of consciousness/limbs paralysis), CPR can be stopped	7
	Questions about airway management	
8	Before starting artificial ventilation, opening of the airway is necessary	93.1
9	The first ventilation in CPR consists of two repeated respirations to the patient	75.5
10	In CPR performed in the hospital using oxygen, the use of a high percentage is necessary	60.2
11	The chest must come up clearly with every artificial respiration	86.0
12	At the beginning of CPR, hyperventilation is necessary	30
13	Length of time for artificial respiration is 1 second in all age groups	36.8
14	When there is only one rescuer, mouth-to-mouth or mouth-to-mask artificial respiration is more effective than ventilation using bag valve mask	40.0
15	Capnography is the most reliable way of assurance of placement of the endotracheal tube in the windpipe	45.7
16	There is no need for a laryngoscope for the preparation of laryngeal mask embedding and combitube	43.0
17	The longest permitted duration of cardiac massage cessation for placement of endotracheal tube is 10 seconds	66
18	At the time of placement control of endotracheal tube in the windpipe, cardiac massage must be stopped	38.6
	Questions about external cardiac massage	
19	In an unwitnessed cardiac arrest, first, cardiac massage and respiratory ventilation must be performed for 2 complete minutes	72.5
20	After 2 minutes of complete cardiac massage and respiratory ventilation, the patient's pulse must be controlled for the first time	80.1
21	The time necessary for determination of the existence of a pulse in the patient is 10 seconds	65.1
22	In the first minute of witnessed cardiac arrest, cardiac massage is more important than respiratory ventilation	77.4
23	Cardiac massage must be performed rapidly and with force	62.6
24	The least number of times of cardiac massage are 100 times per minute in all ages (except infants)	59.8
25	Ratio of cardiac massage to respiration in all ages for usual rescuers is 30:2	72.8
26	Ratio of cardiac massage to respiration in hospitals is 3:1 in infants	47.0
27	Ratio of cardiac massage to respiration in children by 2 professional rescuers is 15:2	70
28	An adult's chest must be pressed to the extent of 4–5 centimeters in every massage	88.9
29	For every massage, the heel of the hand of the rescuer must be placed in the middle of chest and between the lines that attach the head of the chest	80.6
30	After every massage, the chest must be permitted to completely return to its initial place	80.1
	Questions about advanced CPR	
31	In the case of ventricular fibrillation, shock must be given 3 times	29.6
32	Outside the hospital, before using automatic electroshock, CPR must be performed for 2 complete minutes	68.2
33	If the rescuer does not know the energy extent for finishing ventricular fibrillation, 200 J must be selected in biphasic machine and 360 J in monophasic machine	26.8
34	If the patient's pulse does not return after electroshock unloading, CPR must be continued for 2 minutes	75.9
35	In the case of asystole, skin pacemaker must be used	45.3
36	After failure of treatment with epinephrine and defibrillation medicine, vasopressin can be used	49.2
37	If venous puncture cannot be conducted on the patient, interosseous injection is recommended	35.0
38	The first medicine for controlling ventricular dysrhythmias is amiodarone	58.6
39	Dosage of interosseous injected medicine must be 2-2.5 times that of venous dose	23.0
40	If CPR is successful in adults, induced hypothermia must be used	32.8

CPR: Cardiopulmonary resuscitation

relationship was observed between age and CPR knowledge in hospital nurses ( $P = 0.75$ ). In addition, gender (men:  $P > 0.6$ ) (women:  $P > 0.3$ ) and work experience ( $P > 0.85$ ) had no significant association with CPR knowledge among emergency medical staff or hospital nurses.

Table 3 illustrates that CPR knowledge, based on the 2010 guidelines, was not different among emergency medical staff with different educational degrees ( $P = 0.43$ ). However, nurse's aides, in comparison to emergency staff and other educational degrees, had higher knowledge of airway management ( $P = 0.036$ ). In addition, individuals with discontinuous bachelor degree had higher knowledge of advanced CPR performance than emergency personnel and other educational degrees ( $P = 0.021$ ). No significant difference was found in CPR knowledge among hospital nurses with different educational degrees ( $P = 0.39$ ).

Based on the most recent guidelines for CPR, the emergency staff in different locations did not have different CPR knowledge ( $P = 0.65$ ). In addition, location-stratified analyses revealed a significant difference in CPR knowledge among nurses in different hospital wards ( $P < 0.001$ ), so that their knowledge score in order of high to low was coronary care unit (CCU) nurses ( $P < 0.001$ ), internal ward nurses ( $P = 0.006$ ), special unit nurses ( $P = 0.005$ ), and operating and emergency room nurses [Table 3].

In this study, 83.6% of emergency medical staff had passed CPR training courses. CPR knowledge including legal aspects of CPR ( $P = 0.04$ ), airway management ( $P = 0.02$ ), and advanced CPR ( $P = 0.03$ ) according to the most recent guidelines was significantly higher in emergency staff who had passed basic CPR courses compared with those who had not ( $P = 0.018$ ). Furthermore, total CPR knowledge score was higher in nurses who had passed basic CPR courses compared with those who had not passed these courses ( $P = 0.01$ ) [Table 4].

## Discussion

In this study, level of awareness of the latest changes in resuscitation according to the 2010 guidelines of 20.2%, 65.4%, 14%, and 3% of nurses was perfect, good, moderate, and weak, respectively. This level among 19.5%, 78.6%, and 1.9% of emergency medical staff was excellent, good, moderate, and weak, respectively. One study in the USA showed that CPR knowledge and performance of 60 emergency medical technicians working in 31 urban stations was poor and moderate<sup>[8]</sup> according to the latest CPR guidelines. Passali *et al.* reported that the knowledge of nurses and physicians in Greece on principles of ALS and BLS was not sufficient.<sup>[7]</sup> A study conducted by Preusch *et al.* in Heidelberg University, Germany, showed a lack of CPR knowledge among nurses.<sup>[6]</sup> This study reported that basic

**Table 2: Demographic characteristics of emergency medical staff and nurses**

Emergency medical staff	Mean (SD) or percentage	Nurses	Mean (SD) or percentage
Women	6.4%	Women	77.3%
Age	30 (6.5)	Age	32.7 (7.3)
Nurse's aides	35.8%	Nursing technicians	6.5%
Emergency medical technicians	36.5%	Bachelor's degree	86.7%
Bachelor's degree	20.8%	Discontinuous bachelor's degree	4%
Discontinuous bachelor's degree	6.9%	Graduate degree	2.8%
Work experience	8.5 (6.3)	Work experience	9.4 (8.2)
Basic CPR courses	83.6%	Basic CPR courses	91.7%

SD: Standard deviation, CPR: Cardiopulmonary resuscitation

resuscitation training courses based on the new guidelines are required for nurses.<sup>[6]</sup>

It has also been reported that, in Japan, most nurses are not aware of the latest CPR guidelines, and training courses on new CPR principles are needed.<sup>[12]</sup> In Iran, one study indicated that the basic CPR knowledge of medical staff was insufficient.<sup>[11]</sup> In China, the lack of CPR knowledge was reported in both clinical and health nurses.<sup>[13]</sup> In a study in India, a severe lack of BLS knowledge was observed in 1054 nurses, physicians, and nursing students.<sup>[14]</sup>

In our study, there was no significant difference between emergency medical staff and hospital nurses in terms of CPR knowledge based on the latest guidelines. However, the electroconvulsive therapy (ECT) and AED knowledge of emergency medical staff was higher than nurses, although this difference was not significant. In line with our findings, Borimnejad *et al.* reported that work experience had no effect on CPR knowledge of nurses.<sup>[15]</sup> However, in contrast with our findings, Mohsenpour *et al.* reported that nurses in Kerman, Iran, with high working experience had high CPR knowledge.<sup>[16]</sup> One of the most important findings of our study was that older emergency staff had lower CPR knowledge, which should be considered in training programs for the personnel.

Based on our findings, emergency personnel with a history of basic CPR training courses and independent CPR performance had higher CPR knowledge compared with those who had not passed these courses. Nevertheless, Borimnejad *et al.* reported that CPR training courses have no effect on the rate of personnel's knowledge.<sup>[15]</sup> Emphasis on CPR training programs and inattention to independent



**Table 3: The association of education and location with CPR knowledge**

Emergency medical staff		P value <sup>†</sup>	Nurses		P value <sup>†</sup>
Variables	Mean (SD)		Variables	Mean (SD)	
Education					
Nurse's aides*	56 (6)	0.43	Nursing technicians	22 (2.1)	0.39
Emergency medical technicians	58 (6.3)		Bachelor's degree	286 (21.3)	
Bachelor's degree	33 (3.3)		Discontinuous bachelor's degree	13 (2.4)	
Discontinuous bachelor's degree**	12 (1)		Graduate	9 (1.3)	
Location					
Headquarter	29 (3.6)	0.65	Operating and emergency room	106 (12.1)	<0.001
Urban***	114 (9.8)		Special unit****	156 (21.3)	
Road bases****	16 (2.3)		Internal ward	68 (2.4)	

SD: Standard deviation, <sup>†</sup>Obtained from analysis of variance (ANOVA), \*Significantly higher knowledge of advanced CPR than emergency staffs with bachelor's and Discontinuous bachelor's degree ( $P<0.05$ ), \*\*Significantly lower knowledge of advanced CPR than other emergency staffs with different degrees ( $P<0.05$ ), \*\*\*Significantly higher knowledge of advanced CPR than other emergency staffs with different location ( $P<0.05$ ), \*\*\*\*Significantly lower knowledge of advanced CPR than other emergency staffs with different location ( $P<0.05$ ), \*\*\*\*\*Significantly higher knowledge of advanced CPR than personnel of other wards ( $P<0.05$ )

**Table 4: The differences in CPR knowledge between personnel with and without basic CPR training**

Variables	With basic CPR training		Without basic CPR training		P value <sup>†</sup>
	Mean	SD	Mean	SD	
	Emergency staff				
CPR laws	5.4	0.7	3.9	1	0.04
Airway management	9.7	1.9	6.6	1.4	0.02
External cardiac massage	9.9	1.4	6.5	1.4	0.03
Advanced CPR	6.8	1.5	6.5	1.5	0.45
Total knowledge of CPR	28	3.4	21.2	3.1	0.018
Nurses					
CPR laws	6.8	0.8	3.1	1.5	0.003
Airway management	7.6	1.5	4.2	1.4	0.03
External cardiac massage	9.8	1.4	7.2	1.2	0.04
Advanced CPR	6.7	1.6	6.5	0.9	0.76
Total knowledge of CPR	27	3.4	22.4	3.1	0.01

SD: Standard deviation, CPR: Cardiopulmonary resuscitation, <sup>†</sup>Obtained from independent sample *t*-test

CPR performance may be the reason for this finding. Given the beneficial effect of CPR courses demonstrated in this study, CPR training workshops at least every 6 months are recommended for emergency medical staff. This method is also suggested in other studies.<sup>[3]</sup> In our study, the CPR knowledge of emergency staff was not different in terms of working location. However, Brown *et al.* showed that urban emergency staff have poor and moderate CPR knowledge, based on the 2000 guidelines, compared with staff in other locations.<sup>[8]</sup>

In this study, the total score of CPR knowledge was not significantly different among nurses and emergency staff with different educational degrees. This finding was confirmed by Guyette *et al.* who assessed the knowledge of emergency medical personnel.<sup>[9]</sup>

Low CPR knowledge of nurses and emergency staff based on advanced CPR principles, as a finding of our study, was confirmed by other similar studies.<sup>[7]</sup> Inadequate skills to determine and diagnose the patients is the main reason for low knowledge of advanced CPR in nurses and newly graduated doctors.<sup>[17]</sup> Hence, it is necessary to incorporate advanced CPR principles in retraining programs for nurses and emergency personnel according to the 2010 guidelines. This suggestion was also presented in the study by Perkins *et al.* to increase advanced CPR quality.<sup>[18]</sup>

The knowledge of emergency medical staff on the use of ECT and AED was appropriate. This finding was in line with results of the study by Xanthos *et al.* who recommended BLS and AED retraining programs for nurses.<sup>[19]</sup> The CPR knowledge questionnaire regarding airway management illustrated that the knowledge of emergency medical staff in terms of laryngeal mask embedding (LMA) and Combitube was higher than nurses. This finding was also reported in the study by Guyette *et al.*<sup>[9]</sup> The study by Wiese *et al.* showed that laryngeal mask embedding is more effective than ventilation with Ambu Bag for airway management,<sup>[20]</sup> and therefore, retraining programs in this regard are crucial.

The knowledge of nurses and emergency medical personnel on CPR legal issues was not at an acceptable level; thus, it is essential to incorporate the legal aspects of CPR and appropriate examples on beginning or finishing CPR in retraining programs, as mentioned by Rittenberger *et al.* In this study, the knowledge of nurses and emergency medical staff on the use of interosseous infusion instead of injection into the endotracheal tube and induced hypothermia was poor, which is consistent with the results of previous studies.<sup>[10]</sup> Hence, this issue should be considered in retraining programs. Based on our findings, it is essential to hold continuous retraining

programs in academic centers on CPR for hospital nurses and emergency medical staff according to the latest guidelines of CPR.<sup>[12,21]</sup>

Some limitations should be considered for interpreting our findings. First, our study was questionnaire-based and recall bias could be occurred. Second, we could not report our findings based on confounders including age and gender. Another limitation was low sample size in our study. Hence, further study considering mentioned limitations are needed in this regard.

## Conclusion

CPR retraining courses based on the 2010 guidelines with greater emphasis on embedding laryngeal airway and Combitube, legal aspects of CPR, interosseous infusion, and induced hypothermia are required for hospital nurses and emergency medical staff.

## Acknowledgement

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## Conflicts of interest

There are no conflicts of interest.

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